

Distribution of Age-1 & Age-2 Walleye Pollock in the North Pacific: Sources of Variation, Implications for Higher Trophic Levels & Climate Change

L. Ciannelli¹, J. T. Duffy-Anderson², T. Honkalehto², K. Bailey², S. Sogard³, A. Springer⁴, T. Buckley²

¹University of Washington, JISAO, Seattle, WA, USA; ²Alaska Fisheries Science Center, Seattle, WA, USA, ³National Marine Fisheries Service, Santa Cruz, CA, USA; ⁴University of Alaska Fairbanks, Fairbanks, AK, USA



Introduction & Objectives

Introduction

Preliminary evidence (see fig. 1) from the Eastern Bering Sea (EBS) suggests that age-1 and age-2 pollock schools may be vertically separated, with age-1 pollock located on-bottom during daytime hours and age-2 pollock schooling higher in the water column. At present, the factors that motivate any presumed stratification are unexplained, and it is also unknown whether any spatial partitioning of immature walleye pollock occurs in the Gulf of Alaska (GOA). Here we present a multi-faceted approach designed to examine cohort-specific spatial partitioning in the EBS and GOA and to investigate potential motivating factors.

Objectives

- Examine spatial distribution of age-1 and age-2 walleye pollock in the EBS and GOA
- Relate observed patterns to predominant physical and biological characteristics
- Compare and contrast observations between GOA and EBS

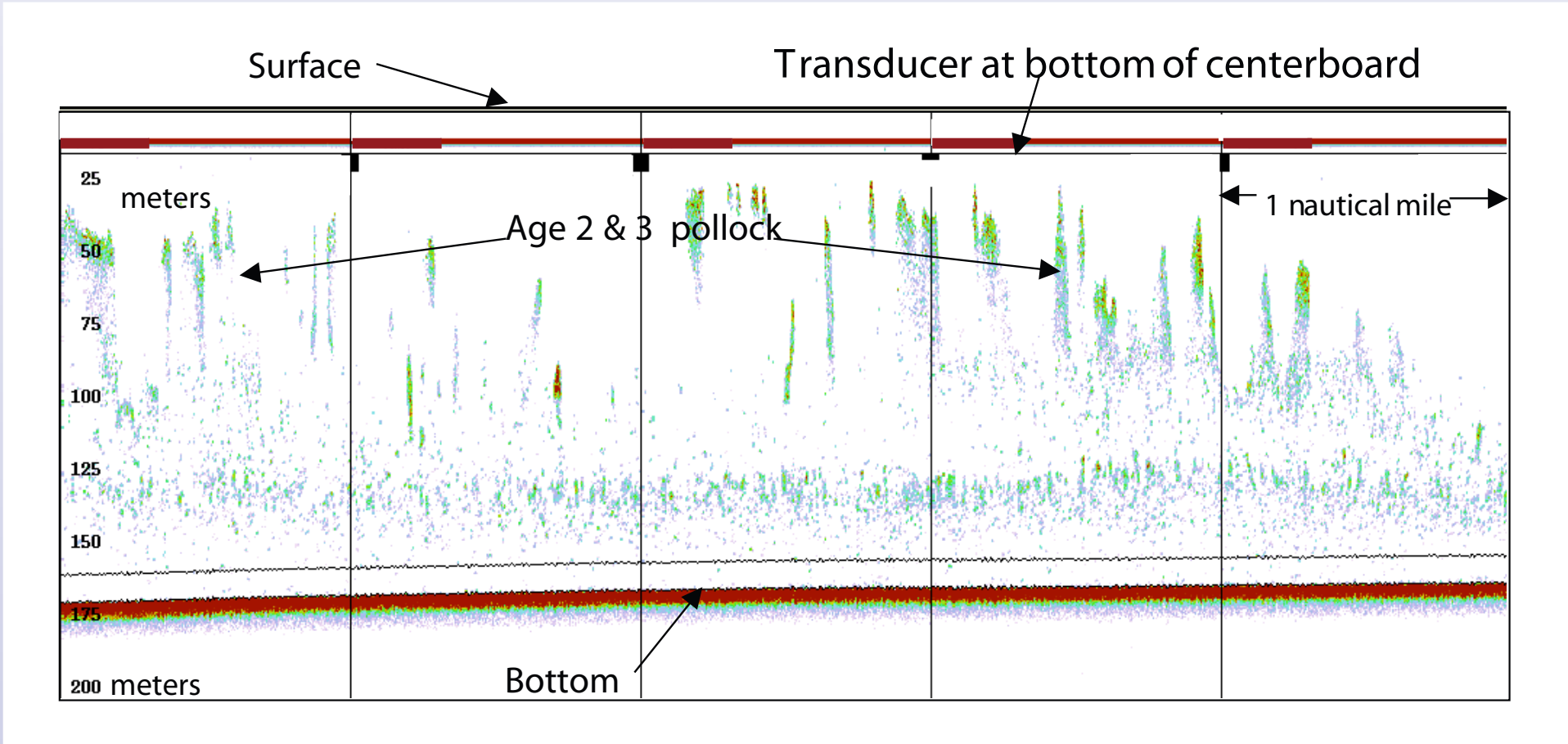


Figure 1

Lines of Research & Results

Field Studies (GOA & EBS)

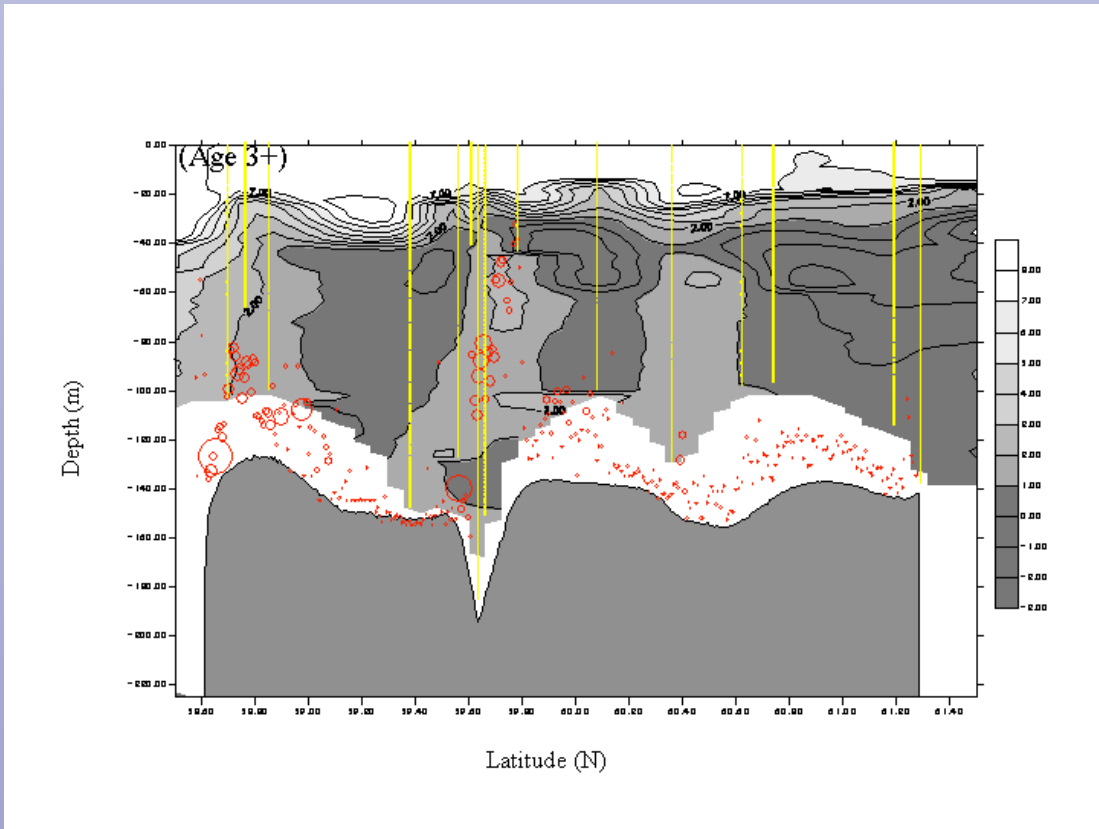


Figure 2
Age-1 and age-2 pollock show vertical separation in the EBS:
Preliminary analysis of acoustic-trawl and temperature data from the summer 1999 echo integration-trawl survey of walleye pollock on the EBS shelf. Red circles are pollock at their weighted average depth in the water column. Circle size is proportional to numbers of pollock. Yellow drop lines are temperature profile locations at trawl hauls. Temperature (°C) is contoured. Pollock appear to be concentrated in areas where the water temperature is >1 °C.

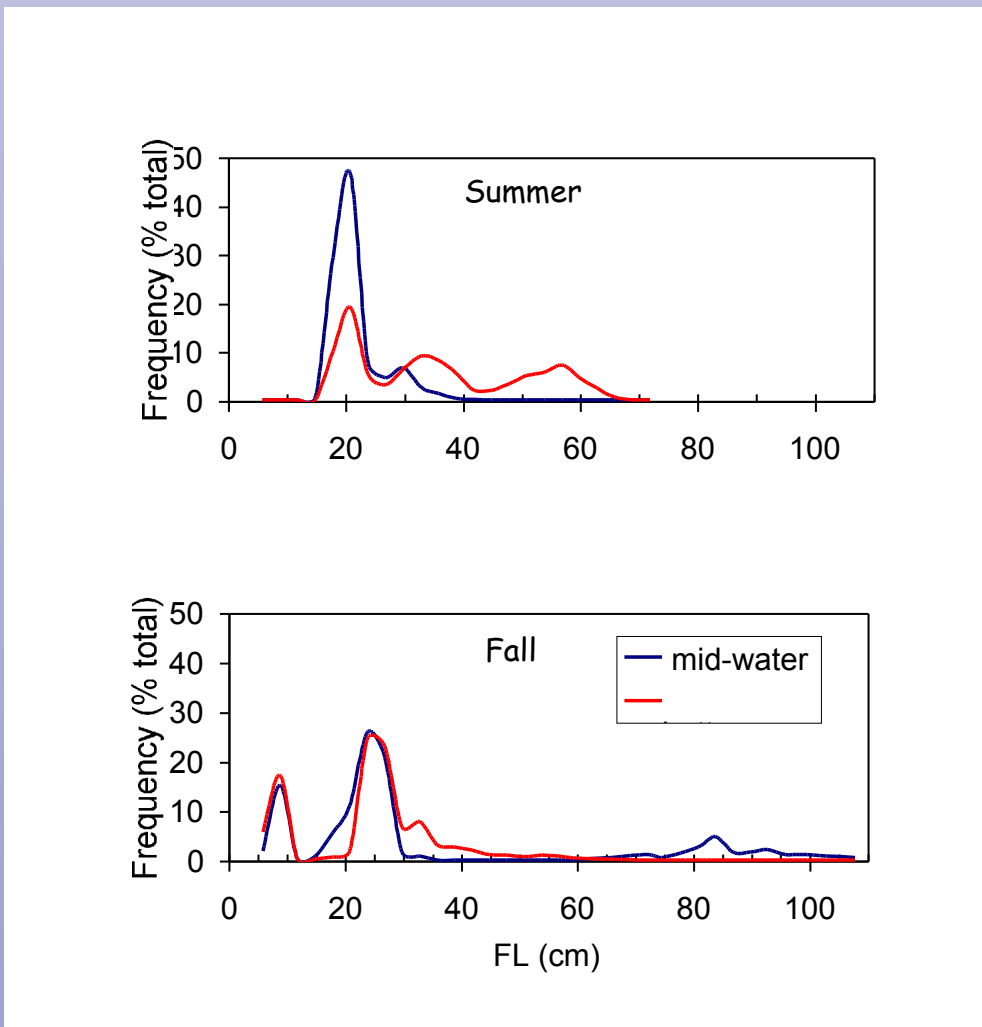


Figure 3
No evidence of separation between age-1 and age-2 in the GOA:
Pollock size distribution as a function of towing depth (mid-water, bottom) during two different surveys (summer, fall) in the Gulf of Alaska.
Evidence of vertical stratification between adults and juveniles in both EBS and GOA.
- Adults on bottom during the day
- Juveniles higher in the water column

Physiological Analysis

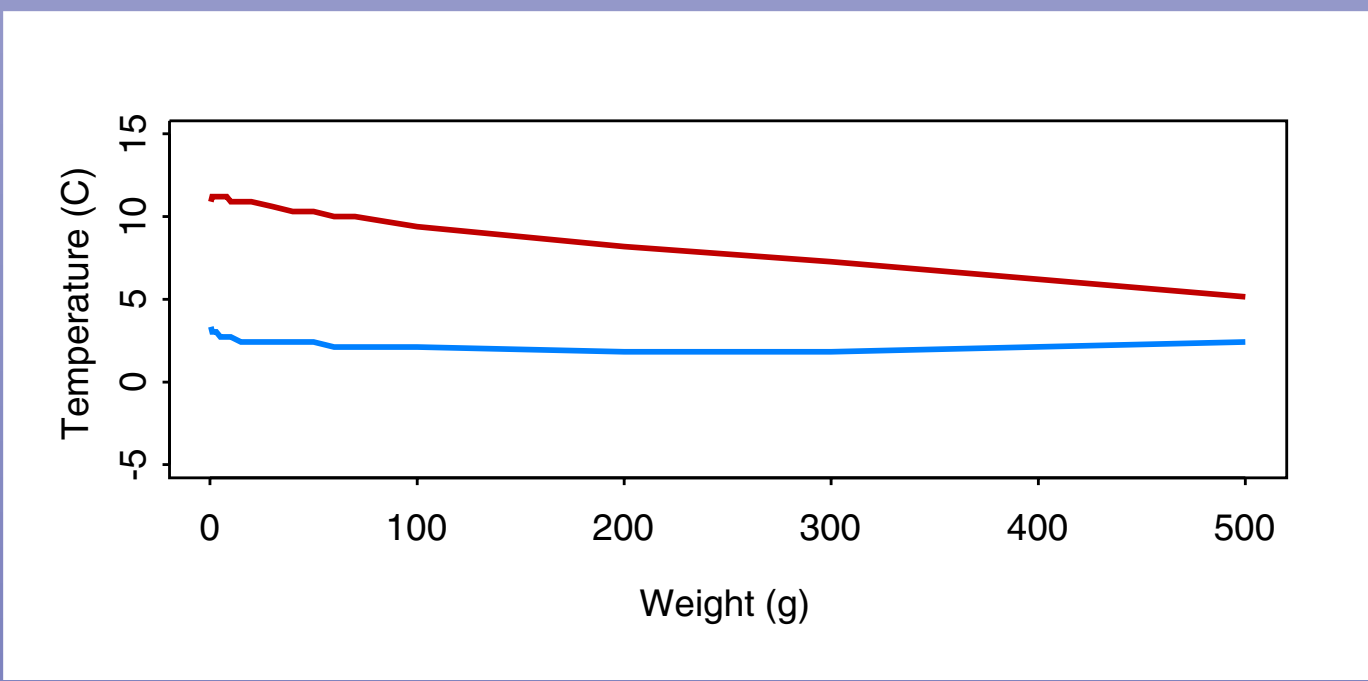


Figure 4
Greater range of temperature tolerance in younger fish. Thermal range of pollock as a function of weight (g). The thermal range includes temperature interval within which fish can reach 50% of the maximum growth rate.



cartoons by Rachael Cartwright and William Rugen

Feeding & Diet Analysis

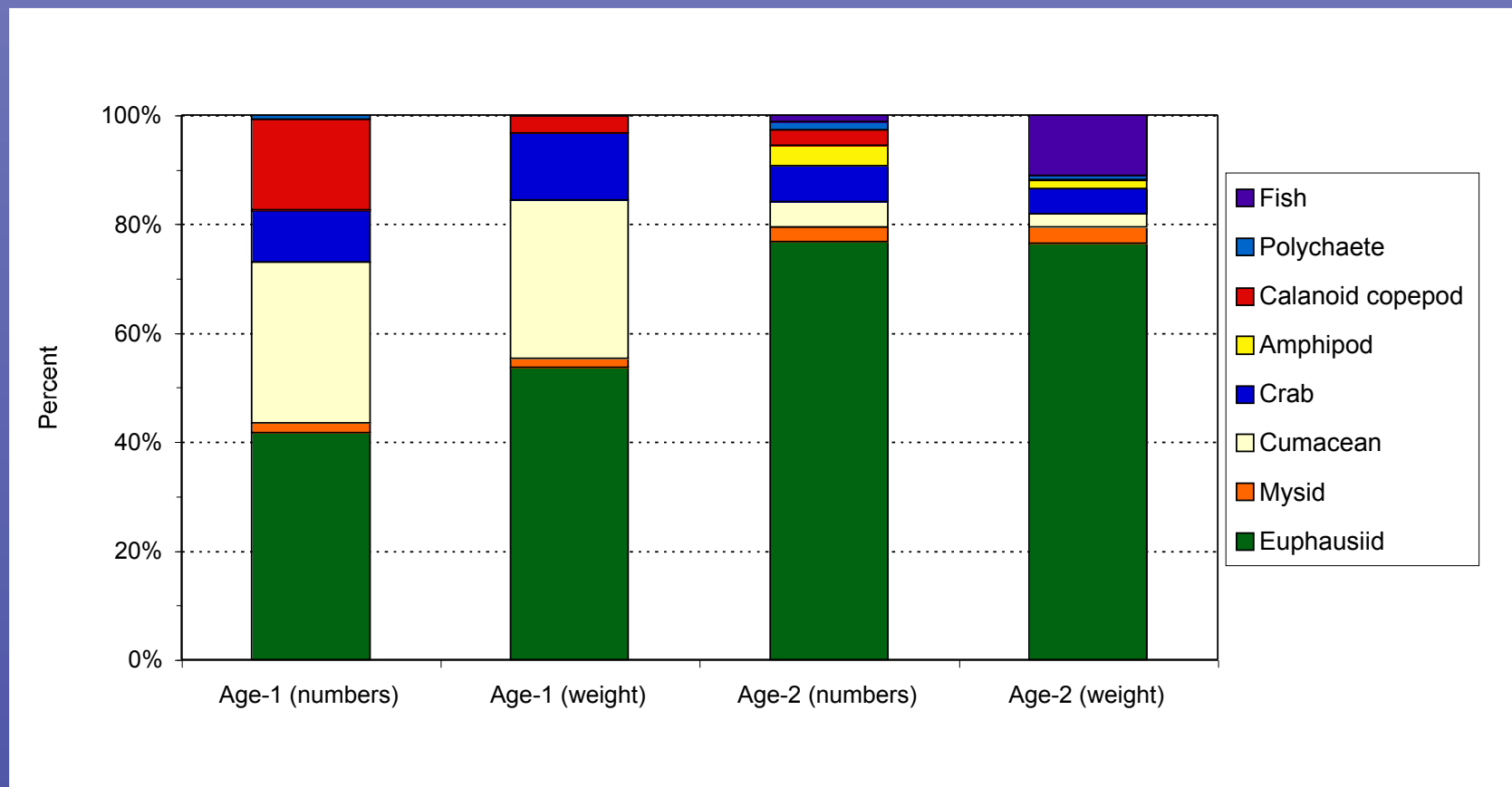


Figure 5
Little evidence of cannibalism in the GOA. Figure shows size-specific pollock diet in the GOA. Dissections by B. Holladay.

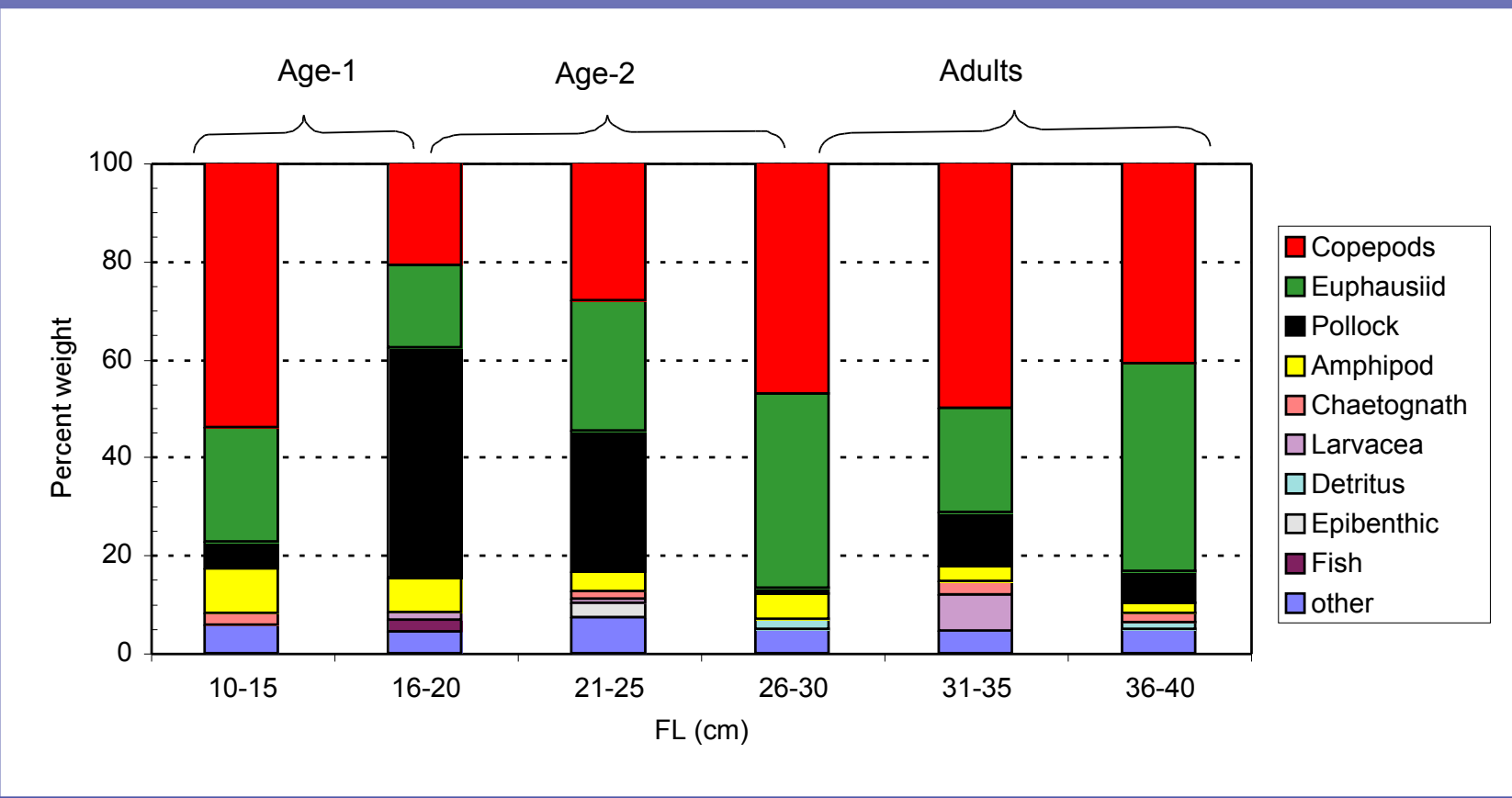


Figure 6.
Evidence of cannibalism in the BS. Figure shows size-specific pollock diet in the EBS.

Behavioral Experimental Studies

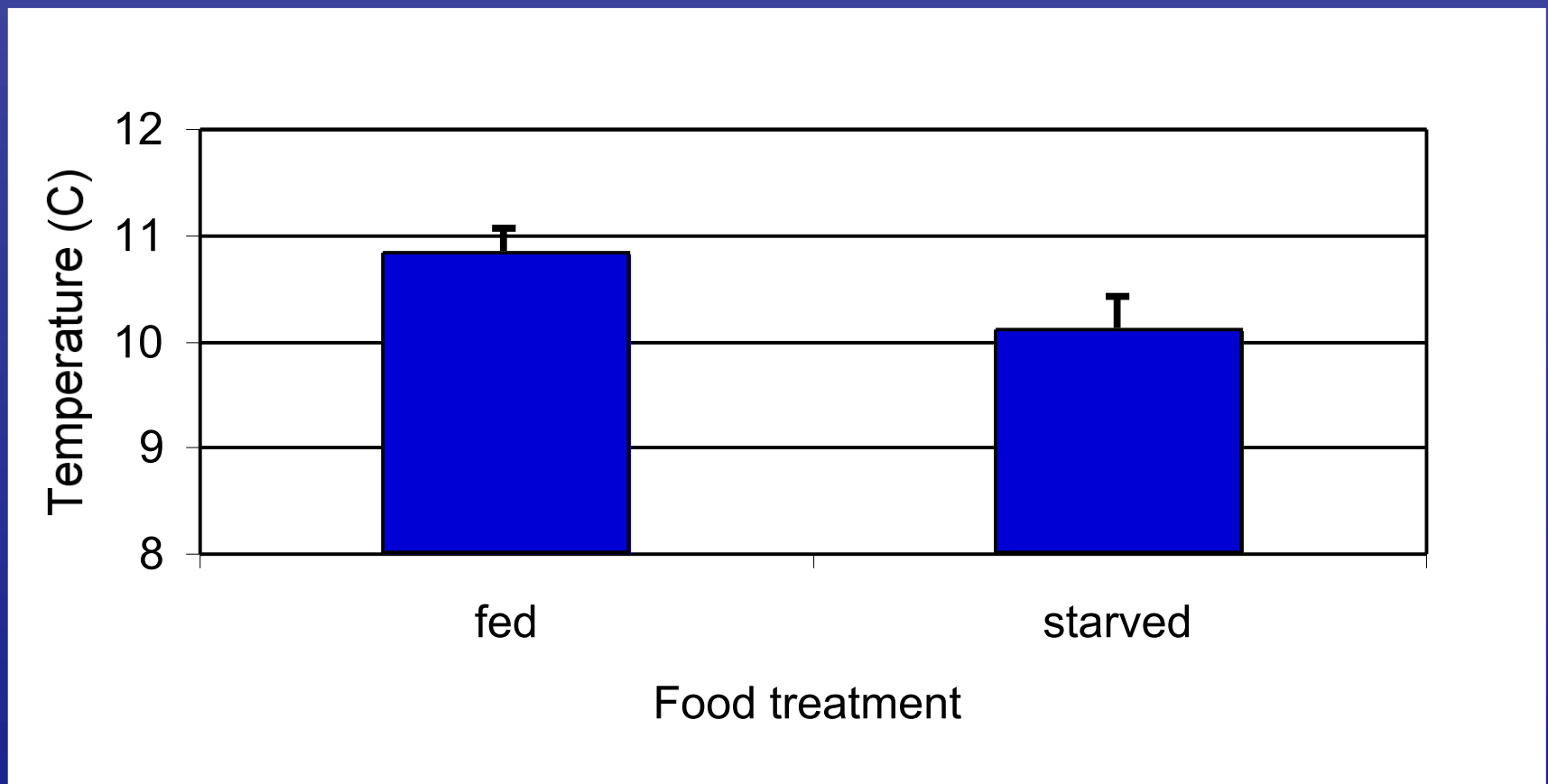


Figure 7
There is no statistical difference of behavioral thermoregulation between starved and fed age-2 pollock. Figure shows temperature experienced by fed and starved age-2 pollock after free positioning in a vertical thermal gradient tank.

Conclusions

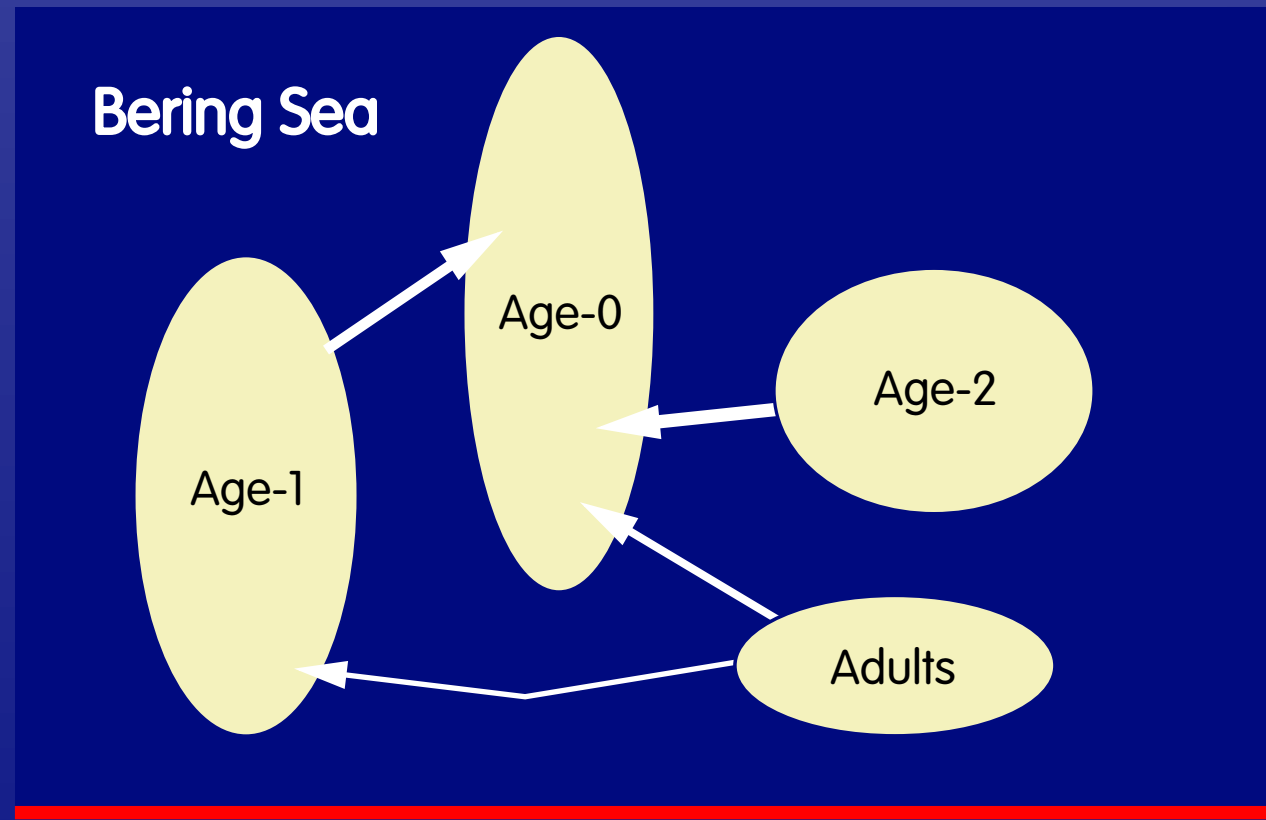


Figure 8
Age-0 pollock exploit most of the water column because they enjoy the widest temperature tolerances and they are subject to intensive intraspecific predation. Age-2 pollock occur higher in the water column to feed on age-0 individuals.

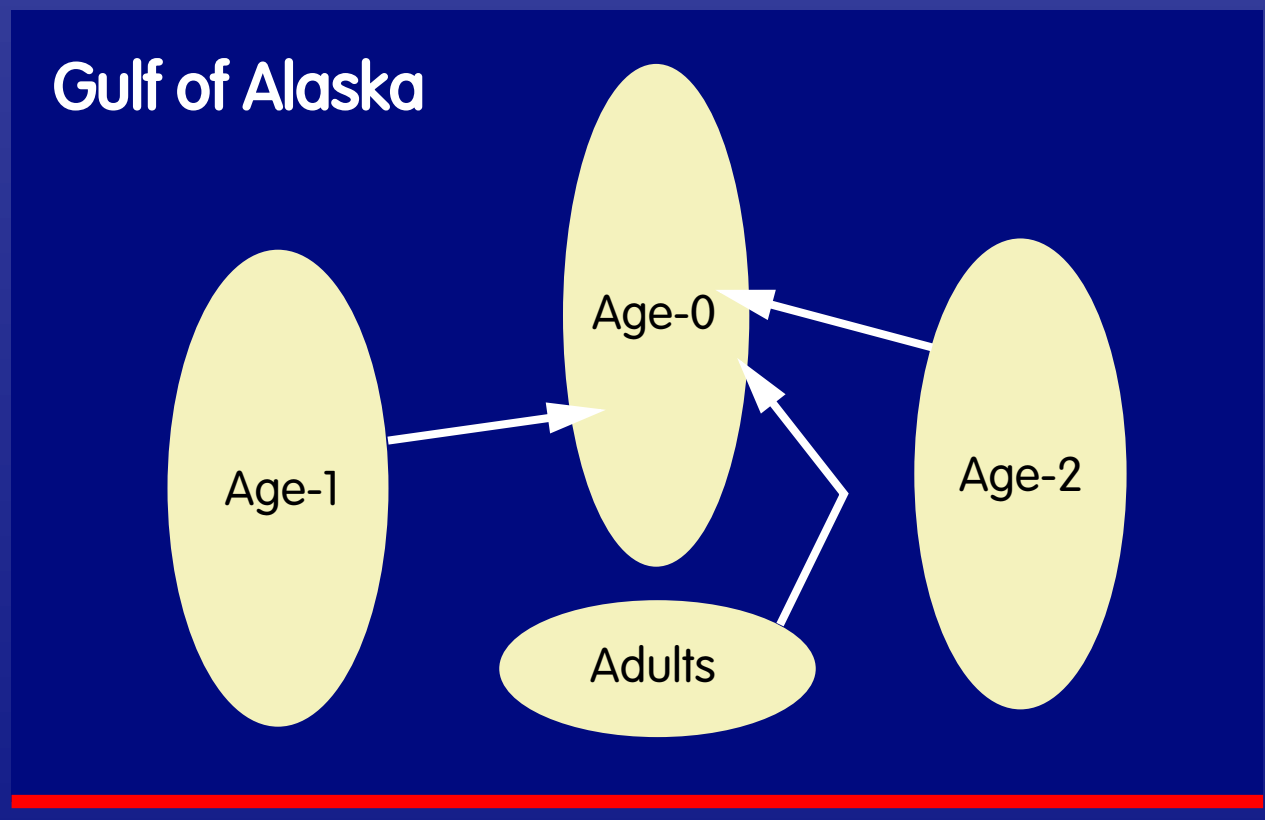


Figure 9
Age-0, age-1, and age-2 pollock occur throughout the water column, with age-0s occurring well off-bottom. All cohorts are subject to less intensive intra-specific predation, though there is some cannibalism of age-0s. **Differences in bottom topography and shelf extent between the BS and the GOA may contribute to observed differences in vertical distribution of cohorts.**